Technetium in Liquid Radioactive Wastes and Environment

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Background. Technetium-99 content in spent fuel is equal about 1Kg/T for power reactors on thermal neutrons and 2-3 Kg/T for fast reactors The accumulation of Tc-99 in all power reactors in the world in 1994 has been calculated to be equal 7,5 T. Technetium-99 is present in all kind of radwastes of spent fuel reprocessing and has been observed in Irish sea and in some lakes and rivers near reprocessing plants in Russia, USA and France. The oxidation state Tc(VII) is predominent in Purex process solutions, in liquid wastes and in natural waters which don't contain H_2S and others reductants. The migration of technetium in natural waters and its sorption by natural rocks and minerals have been reported by a number of authors and summarized by K. Yoshihara . The majority of rocks and minerals have been shown to adsorb Tc(VII) weakly from natural waters. A few minerals, containing iron and lead in low oxidation state (II) have been shown by T. Vandergraaf et al. to be able to sorb technetium. The strong sorption of technetium by antimony-containing minerals has been reported. H. Zhuang et al. from China and A.Winkler et al. from Germany have discovered the sorption of Tc with distribution coefficient $2\cdot10^3$ from natural water by stibnite, rare mineral, consisting mainly of antimony sulfide Sb_2S_3. H. Zhuang et al. propose the sorption of Tc is probably due to the reduction of Tc(VII) toTc(IV). The minerals of the same type and different origin have different ability to Tc sorption. So, the samples of granite from China Hebei province don't sorb Tc and the granite samples from Underground Laboratory near Pinava, Manitoba,Canada and those from Stripa area, Sveden have shown significant sorption of Tc.

Results and discussion. This work describes the sorption of Tc from simulant of natural water and liquid wastes by 17 minerals and a number of real samples (kern, core), taken from the drills in underground injection repository of liquid radwastses in Krasnojarsk Sibir area. The effect of gamma-radiation on technetium sorption from simulated wastes is describes also.The goal of this work is the development of scientifique base for the prediction of technetium behaivior and migration in natural waters and underground repository of liquid wastes.

The main minerals in this repository are field spars (orthoclase $KAlSi_3O_8$), quartz and kaolinite $Al_2[Si_2O_5](OH)_4$. The composition of simulated natural water and liquid radwastes are given in Tables 1, 2. The sorption has been investigated in static conditions by bath technique. The distribution coefficient of technetium sorption K_d has been calculated by well known equation

$$Kd = \frac{V}{W} * \frac{C_0 - C}{C},$$ where

V-the volume of solution, ml ; *W*-the weight of sample, g ; C_o and *C*- the concentration or radioactivity of the solution before and after the sorption.

The results on Tc-99 sorption from seam water by minerals are given in the Table 3. Small K_d values have been obtained for the majority of tested minerals including main